A&A 652, C4 (2021)
https://doi.org/10.1051/0004-6361/201833910e

Astronomy & Astrophysics
Special issue

Planck 2018 results

Planck 2018 results

VI. Cosmological parameters *(Corrigendum)*

Planck Collaboration: N. Aghanim[54], Y. Akrami[15,57,59], M. Ashdown[65,5], J. Aumont[95], C. Baccigalupi[78], M. Ballardini[21,41], A. J. Banday[95,8], R. B. Barreiro[61], N. Bartolo[29,62], S. Basak[85], R. Battye[64], K. Benabed[55,90], J.-P. Bernard[95,8], M. Bersanelli[32,45], P. Bielewicz[75,78], J. J. Bock[63,10], J. R. Bond[7], J. Borrill[12,93], F. R. Bouchet[55,90], F. Boulanger[89,54,55], M. Bucher[2,6], C. Burigana[44,30,47], R. C. Butler[41], E. Calabrese[82], J.-F. Cardoso[55,90], J. Carron[23], A. Challinor[58,65,11], H. C. Chiang[25,6], J. Chluba[64], L. P. L. Colombo[32], C. Combet[68], D. Contreras[20], B. P. Crill[63,10], F. Cuttaia[41], P. de Bernardis[31], G. de Zotti[42], J. Delabrouille[2], J.-M. Delouis[67], E. Di Valentino[64], J. M. Diego[61], O. Doré[63,10], M. Douspis[54], A. Ducout[66], X. Dupac[35], S. Dusini[62], G. Efstathiou[65,58,⋆], F. Elsner[72], T. A. Enßlin[72], H. K. Eriksen[59], Y. Fantaye[3,19], M. Farhang[76], J. Fergusson[11], R. Fernandez-Cobos[61], F. Finelli[41,47], F. Forastieri[30,48], M. Frailis[43], A. A. Fraisse[25], E. Franceschi[41], A. Frolov[87], S. Galeotta[43], S. Galli[55,90,⋆], K. Ganga[2], R. T. Génova-Santos[60,16], M. Gerbino[38], T. Ghosh[81,9], J. González-Nuevo[17], K. M. Górski[63,97], S. Gratton[65,58], A. Gruppuso[41,47], J. E. Gudmundsson[94,25], J. Hamann[86], W. Handley[65,5], F. K. Hansen[59], D. Herranz[61], S. R. Hildebrandt[63,10], E. Hivon[55,90], Z. Huang[83], A. H. Jaffe[53], W. C. Jones[25], A. Karakci[59], E. Keihänen[24], R. Keskitalo[12], K. Kiiveri[24,40], J. Kim[72], T. S. Kisner[70], L. Knox[27], N. Krachmalnicoff[78], M. Kunz[14,54,3], H. Kurki-Suonio[24,40], G. Lagache[4], J.-M. Lamarre[89], A. Lasenby[5,65], M. Lattanzi[48,30], C. R. Lawrence[63], M. Le Jeune[2], P. Lemos[58,65], J. Lesgourgues [56], F. Levrier[89], A. Lewis[23,⋆], M. Liguori[29,62], P. B. Lilje[59], M. Lilley[55,90], V. Lindholm[24,40], M. López-Caniego[35], P. M. Lubin[28], Y.-Z. Ma[77,80,74], J. F. Macías-Pérez[68], G. Maggio[43], D. Maino[32,45,49], N. Mandolesi[41,30], A. Mangilli[8], A. Marcos-Caballero[61], M. Maris[43], P. G. Martin[7], M. Martinelli[96], E. Martínez-González[61], S. Matarrese[29,62,37], N. Mauri[47], J. D. McEwen[73], P. R. Meinhold[28], A. Melchiorri[31,50], A. Mennella[32,45], M. Migliaccio[34,51], M. Millea[27,88,55], S. Mitra[52,63], M.-A. Miville-Deschênes[1,54], D. Molinari[30,41,48], L. Montier[95,8], G. Morgante[41], A. Moss[84], P. Natoli[30,92,48], H. U. Nørgaard-Nielsen[13], L. Pagano[30,48,54], D. Paoletti[41,47], B. Partridge[39], G. Patanchon[2], H. V. Peiris[22], F. Perrotta[78], V. Pettorino[1], F. Piacentini[31], L. Polastri[30,48], G. Polenta[92], J.-L. Puget[54,55], J. P. Rachen[18], M. Reinecke[72], M. Remazeilles[64], A. Renzi [62], G. Rocha[63,10], C. Rosset[2], G. Roudier[2,89,63], J. A Rubiño-Martín[60,16], B. Ruiz-Granados[60,16], L. Salvati[54], M. Sandri[41], M. Savelainen[24,40,71], D. Scott[20], E. P. S. Shellard[11], C. Sirignano[29,62], G. Sirri[47], L. D. Spencer[82], R. Sunyaev[72,91], A.-S. Suur-Uski[24,40], J. A. Tauber[36], D. Tavagnacco[43,33], M. Tenti[46], L. Toffolatti[17,41], M. Tomasi[32,45], T. Trombetti[44,48], L. Valenziano[41], J. Valiviita[24,40], B. Van Tent[69], L. Vibert[54,55], P. Vielva[61], F. Villa[41], N. Vittorio[34], B.D. Wandelt[55,90], I. K. Wehus[59], M. White[26], S. D. M. White[72], A. Zacchei[43], and A. Zonca[79]

(Affiliations can be found after the references)

A&A 641, A6 (2020), https://doi.org/10.1051/0004-6361/201833910

Key words. cosmic background radiation – cosmological parameters – errata, addenda

In the original version, the bounds given in Eqs. (87a) and (87b) on the contribution to the early-time optical depth, $\tau(15, 30)$, contained a numerical error in deriving the 95th percentile from the Monte Carlo samples. The corrected 95% upper bounds are:

$$\tau(15, 30) < 0.018 \quad (\text{lowE, flat } \tau(15, 30), \text{FlexKnot}); \tag{1}$$

$$\tau(15, 30) < 0.023 \quad (\text{lowE, flat knot, FlexKnot}). \tag{2}$$

These bounds are a factor of ∼3 larger than the originally reported results. Consequently, the new bounds do not significantly improve upon previous results from *Planck* data presented in Millea & Bouchet (2018) as was stated, but are instead comparable. Equations (1) and (2) give results that are now similar to those of Heinrich & Hu (2021), who used the same *Planck* 2018 data to derive a 95 % upper bound of 0.020 using the principal component analysis (PCA) model and uniform priors on the PCA mode amplitudes.

Acknowledgements. We thank Xiaohan Wu for discussions which led to finding this error.

⋆ Corresponding authors: G. Efstathiou, e-mail: gpe@ast.cam.ac.uk; S. Galli, e-mail: gallis@iap.fr; A. Lewis, e-mail: antony@cosmologist.info

References

Heinrich, C., & Hu, W. 2021, ArXiv e-prints [arXiv:2104.13998]
Millea, M., & Bouchet, F. 2018, A&A, 617, A96

[1] AIM, CEA, CNRS, Université Paris-Saclay, Université Paris-Diderot, Sorbonne Paris Cité, 91191 Gif-sur-Yvette, France
[2] APC, AstroParticule et Cosmologie, Université Paris Diderot, CNRS/IN2P3, CEA/lrfu, Observatoire de Paris, Sorbonne Paris Cité, 10, rue Alice Domon et Léonie Duquet, 75205 Paris Cedex 13, France
[3] African Institute for Mathematical Sciences, 6-8 Melrose Road, Muizenberg, Cape Town, South Africa
[4] Aix Marseille Univ, CNRS, CNES, LAM, Marseille, France
[5] Astrophysics Group, Cavendish Laboratory, University of Cambridge, J J Thomson Avenue, Cambridge CB3 0HE, UK
[6] Astrophysics & Cosmology Research Unit, School of Mathematics, Statistics & Computer Science, University of KwaZulu-Natal, Westville Campus, Private Bag X54001, Durban 4000, South Africa
[7] CITA, University of Toronto, 60 St. George St., Toronto, ON M5S 3H8, Canada
[8] CNRS, IRAP, 9 Av. colonel Roche, BP 44346, 31028 Toulouse cedex 4, France
[9] Cahill Center for Astronomy and Astrophysics, California Institute of Technology, Pasadena, CA 91125, USA

[10] California Institute of Technology, Pasadena, CA, USA
[11] Centre for Theoretical Cosmology, DAMTP, University of Cambridge, Wilberforce Road, Cambridge CB3 0WA, UK
[12] Computational Cosmology Center, Lawrence Berkeley National Laboratory, Berkeley, CA, USA
[13] DTU Space, National Space Institute, Technical University of Denmark, Elektrovej 327, 2800 Kgs. Lyngby, Denmark
[14] Département de Physique Théorique, Université de Genève, 24, Quai E. Ansermet, 1211 Genève 4, Switzerland
[15] Département de Physique, École normale supérieure, PSL Research University, CNRS, 24 rue Lhomond, 75005 Paris, France
[16] Departamento de Astrofísica, Universidad de La Laguna (ULL), 38206 La Laguna, Tenerife, Spain
[17] Departamento de Física, Universidad de Oviedo, C/ Federico García Lorca, 18, Oviedo, Spain
[18] Department of Astrophysics/IMAPP, Radboud University, PO Box 9010, 6500 GL Nijmegen, The Netherlands
[19] Department of Mathematics, University of Stellenbosch, Stellenbosch 7602, South Africa
[20] Department of Physics & Astronomy, University of British Columbia, 6224 Agricultural Road, Vancouver, British Columbia, Canada
[21] Department of Physics & Astronomy, University of the Western Cape, Cape Town 7535, South Africa
[22] Department of Physics and Astronomy, University College London, London WC1E 6BT, UK
[23] Department of Physics and Astronomy, University of Sussex, Brighton BN1 9QH, UK
[24] Department of Physics, Gustaf Hällströmin katu 2a, University of Helsinki, Helsinki, Finland
[25] Department of Physics, Princeton University, Princeton NJ, USA
[26] Department of Physics, University of California, Berkeley, CA, USA
[27] Department of Physics, University of California, One Shields Avenue, Davis, CA, USA
[28] Department of Physics, University of California, Santa Barbara CA, USA
[29] Dipartimento di Fisica e Astronomia G. Galilei, Università degli Studi di Padova, Via Marzolo 8, 35131 Padova, Italy
[30] Dipartimento di Fisica e Scienze della Terra, Università di Ferrara, Via Saragat 1, 44122 Ferrara, Italy
[31] Dipartimento di Fisica, Università La Sapienza, P. le A. Moro 2, Roma, Italy
[32] Dipartimento di Fisica, Università degli Studi di Milano, Via Celoria, 16, Milano, Italy
[33] Dipartimento di Fisica, Università degli Studi di Trieste, Via A. Valerio 2, Trieste, Italy
[34] Dipartimento di Fisica, Università di Roma Tor Vergata, Via della Ricerca Scientifica, 1, Roma, Italy
[35] European Space Agency, ESAC, Planck Science Office, Camino bajo del Castillo, s/n, Urbanización Villafranca del Castillo, Villanueva de la Cañada, Madrid, Spain
[36] European Space Agency, ESTEC, Keplerlaan 1, 2201 AZ Noordwijk, The Netherlands
[37] Gran Sasso Science Institute, INFN, Viale F. Crispi 7, 67100 L'Aquila, Italy
[38] HEP Division, Argonne National Laboratory, Lemont, IL 60439, USA
[39] Haverford College Astronomy Department, 370 Lancaster Avenue, Haverford, PA, USA
[40] Helsinki Institute of Physics, Gustaf Hällströmin katu 2, University of Helsinki, Helsinki, Finland
[41] INAF – OAS Bologna, Istituto Nazionale di Astrofisica – Osservatorio di Astrofisica e Scienza dello Spazio di Bologna, Area della Ricerca del CNR, Via Gobetti 101, 40129 Bologna, Italy
[42] INAF – Osservatorio Astronomico di Padova, Vicolo dell'Osservatorio 5, Padova, Italy
[43] INAF – Osservatorio Astronomico di Trieste, Via G.B. Tiepolo 11, Trieste, Italy
[44] INAF, Istituto di Radioastronomia, Via Piero Gobetti 101, 40129 Bologna, Italy
[45] INAF/IASF Milano, Via E. Bassini 15,, Milano, Italy
[46] INFN – CNAF, Viale Berti Pichat 6/2, 40127 Bologna, Italy
[47] INFN, Sezione di Bologna, Viale Berti Pichat 6/2, 40127 Bologna, Italy
[48] INFN, Sezione di Ferrara, Via Saragat 1, 44122, Ferrara, Italy
[49] INFN, Sezione di Milano, Via Celoria 16, Milano, Italy
[50] INFN, Sezione di Roma 1, Università di Roma Sapienza, Piazzale Aldo Moro 2, 00185 Roma, Italy
[51] INFN, Sezione di Roma 2, Università di Roma Tor Vergata, Via della Ricerca Scientifica, 1, Roma, Italy
[52] IUCAA, Post Bag 4, Ganeshkhind, Pune University Campus, Pune 411 007, India
[53] Imperial College London, Astrophysics group, Blackett Laboratory, Prince Consort Road, London SW7 2AZ, UK
[54] Institut d'Astrophysique Spatiale, CNRS, Univ. Paris-Sud, Université Paris-Saclay, Bât. 121, 91405 Orsay cedex, France
[55] Institut d'Astrophysique de Paris, CNRS (UMR7095), 98 bis Boulevard Arago, 75014 Paris, France
[56] Institut für Theoretische Teilchenphysik und Kosmologie, RWTH Aachen University, 52056 Aachen, Germany
[57] Institute Lorentz, Leiden University, PO Box 9506, Leiden 2300 RA, The Netherlands
[58] Institute of Astronomy, University of Cambridge, Madingley Road, Cambridge CB3 0HA, UK
[59] Institute of Theoretical Astrophysics, University of Oslo, Blindern, Oslo, Norway
[60] Instituto de Astrofísica de Canarias, C/Vía Láctea s/n, La Laguna, Tenerife, Spain
[61] Instituto de Física de Cantabria (CSIC-Universidad de Cantabria), Avda. de los Castros s/n, Santander, Spain
[62] Istituto Nazionale di Fisica Nucleare, Sezione di Padova, Via Marzolo 8, 35131 Padova, Italy
[63] Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA, USA
[64] Jodrell Bank Centre for Astrophysics, Alan Turing Building, School of Physics and Astronomy, The University of Manchester, Oxford Road, Manchester M13 9PL, UK
[65] Kavli Institute for Cosmology Cambridge, Madingley Road, Cambridge CB3 0HA, UK
[66] Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU, WPI), UTIAS, The University of Tokyo, Chiba 277-8583, Japan
[67] Laboratoire d'Océanographie Physique et Spatiale (LOPS), Univ. Brest, CNRS, Ifremer, IRD, Brest, France
[68] Laboratoire de Physique Subatomique et Cosmologie, Université Grenoble-Alpes, CNRS/IN2P3, 53, rue des Martyrs, 38026 Grenoble Cedex, France
[69] Laboratoire de Physique Théorique, Université Paris-Sud 11 & CNRS, Bâtiment 210, 91405 Orsay, France
[70] Lawrence Berkeley National Laboratory, Berkeley, CA, USA
[71] Low Temperature Laboratory, Department of Applied Physics, Aalto University, Espoo 00076, AALTO, Finland
[72] Max-Planck-Institut für Astrophysik, Karl-Schwarzschild-Str. 1, 85741 Garching, Germany
[73] Mullard Space Science Laboratory, University College London, Surrey RH5 6NT, UK
[74] NAOC-UKZN Computational Astrophysics Centre (NUCAC), University of KwaZulu-Natal, Durban 4000, South Africa
[75] National Centre for Nuclear Research, ul. L. Pasteura 7, 02-093 Warsaw, Poland
[76] Physics Department, Shahid Beheshti University, Velenjak, Tehran 19839, Iran
[77] Purple Mountain Observatory, No. 8 Yuan Hua Road, 210034 Nanjing, PR China

[78] SISSA, Astrophysics Sector, Via Bonomea 265, 34136 Trieste, Italy
[79] San Diego Supercomputer Center, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA
[80] School of Chemistry and Physics, University of KwaZulu-Natal, Westville Campus, Private Bag X54001, Durban 4000, South Africa
[81] School of Physical Sciences, National Institute of Science Education and Research, HBNI, Jatni 752050, Odissa, India
[82] School of Physics and Astronomy, Cardiff University, Queens Buildings, The Parade, Cardiff CF24 3AA, UK
[83] School of Physics and Astronomy, Sun Yat-sen University, 2 Daxue Rd, Tangjia, Zhuhai, PR China
[84] School of Physics and Astronomy, University of Nottingham, Nottingham NG7 2RD, UK
[85] School of Physics, Indian Institute of Science Education and Research Thiruvananthapuram, Maruthamala PO, Vithura, Thiruvananthapuram 695551, Kerala, India
[86] School of Physics, The University of New South Wales, Sydney, NSW 2052, Australia
[87] Simon Fraser University, Department of Physics, 8888 University Drive, Burnaby, BC, Canada
[88] Sorbonne Université, Institut Lagrange de Paris (ILP), 98 bis Boulevard Arago, 75014 Paris, France
[89] Sorbonne Université, Observatoire de Paris, Université PSL, École normale supérieure, CNRS, LERMA, 75005 Paris, France
[90] Sorbonne Université, UMR7095, Institut d'Astrophysique de Paris, 98 bis Boulevard Arago, 75014 Paris, France
[91] Space Research Institute (IKI), Russian Academy of Sciences, Profsoyuznaya Str, 84/32, Moscow 117997, Russia
[92] Space Science Data Center – Agenzia Spaziale Italiana, Via del Politecnico snc, 00133 Roma, Italy
[93] Space Sciences Laboratory, University of California, Berkeley, CA, USA
[94] The Oskar Klein Centre for Cosmoparticle Physics, Department of Physics, Stockholm University, AlbaNova 106 91 Stockholm, Sweden
[95] Université de Toulouse, UPS-OMP, IRAP, 31028 Toulouse cedex 4, France
[96] University of Heidelberg, Institute for Theoretical Physics, Philosophenweg 16, 69120 Heidelberg, Germany
[97] Warsaw University Observatory, Aleje Ujazdowskie 4, 00-478 Warszawa, Poland